Mr. Michael T. Davis Algebra II Delta & Eta	Exponential Functions Unit III 2^{nd} half Quiz 1 Practice March 11, 2015

Name: Mr. Davis Solutions

1. Given an exponential function $f(x) = a(b)^x$, what are the values that b can never be, i.e. what are the restrictions on b?

$b \neq 0$ $b \neq 1$ $b \neq$ negative

2. A zombie bacteria strain will double in size every 15 minutes. If a person is infected with 30 bacteria and it takes about 122,880 bacteria for a person to become a zombie, how long will it take for a person to mutate into a zombie? Write a formula to represent this.

$f(x) = 30(2)^x$

$122880 = 30(2)^x$

Try differenent powers for x until you discover 12 works

$f(12) = 30(2)^{12} = 122880$

we double 12 times

12 15-minute periods

is 180 minutes or 3 hours

3. Determine an equation for the exponential function $f(x) = a(b)^x$ with ordered pairs $(0,6)$ & $(1,3)$

$f(x) = 6(b)^x$

$3 = 6(b)^1$

$3 = 6 \cdot b$

$b = \frac{1}{2} \longrightarrow f(x) = 6\left(\frac{1}{2}\right)^x$

4. A radioactive isotope decays in such a way that after every 5,000 years has passed, there remains one-half of the isotope. If there are initially 2,240 grams of the isotope, then how many grams will be present after 40,000 years?

$f(x) = 2240\left(\frac{1}{2}\right)^x$ 40,000 years is 8 5,000 periods

$f(8) = 2240\left(\frac{1}{2}\right)^8 = 8.75$ grams

5. Determine an equation for the exponential function $f(x) = a(b)^x$ with ordered pairs $(1,3)$ & $(2,6)$

going from (1,3) to (2,6) involves multiplying 3 by 2

Therefore $f(x) = a(2)^x$.

using (1,3) $f(x) = a(2)^x$ becomes $3 = a(2)^1$ $a = \frac{3}{2}$

$f(x) = \frac{3}{2}(2)^x$

[redacted]

6. During a free fall, a skydiver falls 16 feet in the first second, 48 feet in the 2nd second, and 80 feet in the third second. If she continues to fall at this rate, how many feet will she fall during the 9th second? Add 32 feet each second

16, 48, 80, 112, 144, 176, 208, 240, 272

She falls 272 feet during the 9th second.

7. Determine an equation for the exponential function $f(x) = a(b)^x$ with ordered pairs ~~(2,16)~~ (1,32) & (6,1)

X	Y
0	64
1	32
2	16
3	8
4	4
5	2
6	1

Trial & error: $32\left(\frac{1}{2}\right) = 16$ $16\left(\frac{1}{2}\right) = 8$

$8\left(\frac{1}{2}\right) = 4$ $4\left(\frac{1}{2}\right) = 2$ $2\left(\frac{1}{2}\right) = 1$

work in reverse to find (0, 64)

$f(x) = 64\left(\frac{1}{2}\right)^x$

8. During a free fall, a skydiver falls 16 feet in the first second, 48 feet in the 2nd second, and 80 feet in the third second. If she continues to fall at this rate, how many feet will she fall during the first nine seconds?

Refer to # 6 above

16 + 48 + 80 + 112 + 144 + 176 + 208 + 240 + 272 = 1,296 feet

9. Does the sequence $100, 20, 4, \frac{4}{5}, \frac{4}{25}, \ldots$ represent an exponential function? If so, explain why and then determine an equation for the function.

$100\left(\frac{1}{5}\right) = 20$ $20\left(\frac{1}{5}\right) = 4$ $4\left(\frac{1}{5}\right) = \frac{4}{5}$ $\frac{4}{5}\left(\frac{1}{5}\right) = \frac{4}{25}$ etc...

the common multiplier or base is $b = \frac{1}{5}$, therefore,

yes the sequence represents an exponential function.

10. Determine an equation for the exponential function $f(x) = a(b)^x$ with ordered pairs ~~(3,10)~~ (1,1000) & $\left(5, \frac{1}{10}\right)$

X	Y
0	10000
1	1000
2	100
3	10
4	1
5	$\frac{1}{10}$
6	$\frac{1}{100}$

it looks like the base b might be $\frac{1}{10}$

working in reverse gives Y = 10000 for X = 0

$f(x) = 10000\left(\frac{1}{10}\right)^x$

11. A colony of bacteria began with 80. The population grows at a rate of 30% every 20 minutes. How many will there be in 4 hours?

$f(x) = 80(1+0.30)^x = 80(1.3)^x$ 4 hours = 240 minutes

$\frac{240 \text{ min}}{20 \text{ min}} = 12$ 20 min periods in 4 hours

$f(12) = 80(1.3)^{12} \approx 1{,}863.85$ or 1,864 bacteria

12. You invest $2,000 in a simple interest bearing savings account for 18 years. The annual interest rate is 5%. What is the future value of your investment in 18 years?

$f(x) = 2000(1+.05)^x$ x = years

$f(18) = 2000(1.05)^{18} \approx \$4{,}813.24$

13. A table of values for an exponential function is shown. Fill in all the missing x-values and corresponding y-values.

X	0	1	2	3	4	5	6
Y	$\frac{125}{4}$	25	20	16	$\frac{64}{5}$	$\frac{256}{5}$	$\frac{1024}{5}$

challenging but doable

$f(x) = a(b)^x$

$25 = a(b)^1$

$\frac{25}{b} = a$

$16 = a(b)^3$

$16 = \frac{25}{b}(b)^3$

$16 = 25b^2$

$\frac{16}{25} = b^2$

$\frac{4}{5} = b$

go back to $\frac{25}{b} = a$

$\frac{25}{\left(\frac{4}{5}\right)} = a$

$\frac{5}{4} \cdot 25 = a$

$\frac{125}{4} = a$

$f(x) = \frac{125}{4}\left(\frac{4}{5}\right)^x$

14. A table of values for an exponential function is shown. Fill in all the missing x-values and corresponding y-values.

X	0	1	2	3	4	5	6
Y	0.0005	0.005	0.05	0.5	5	50	500

looks like the base might be 10

$f(x) = 0.0005(10)^x$

15. You arrive on an island and find 1,215 pairs of bunnies. Four months ago, there were 15 pairs of bunnies. How fast are the bunnies reproducing?

(0, 15) 4 months (1, 45) 3 months (2, 135) 2 months (3, 405) 1 month (4, 1215) arrival

Try b = 2 $15 \cdot 2 = 30$ $30 \cdot 2 = 60$ $60 \cdot 2 = 120$ $120 \cdot 2 = 240$

Try b = 3 $15 \cdot 3 = 45$ $45 \cdot 3 = 135$ $135 \cdot 3 = 405$ $405 \cdot 3 = 1{,}215$

The bunnies are reproducing by a multiple of 3, i.e. the number of bunny pairs triples every month.

16. Match the graph with the information given.

I. $f(x)=a(b)^x$, where $a>0$ & $b>1$

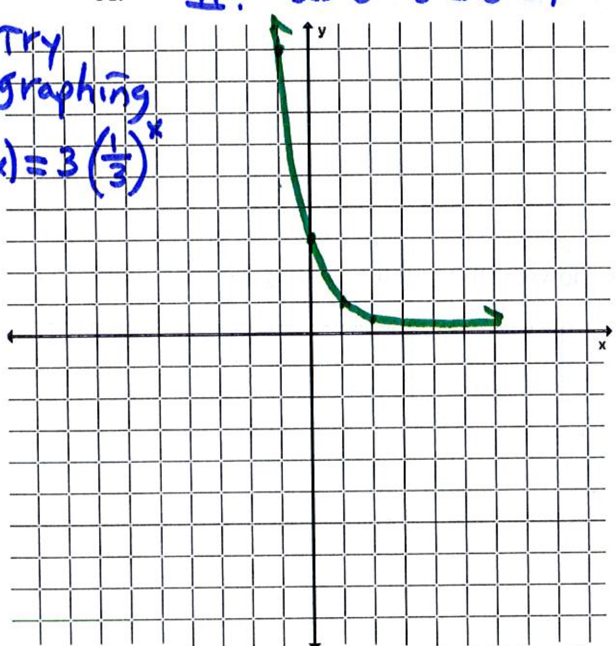
II. $f(x)=a(b)^x$, where $a<0$ & $b>1$

III. $f(x)=a(b)^x$, where $a>0$ & $0<b<1$

IV. $f(x)=a(b)^x$, where $a<0$ & $0<b<1$

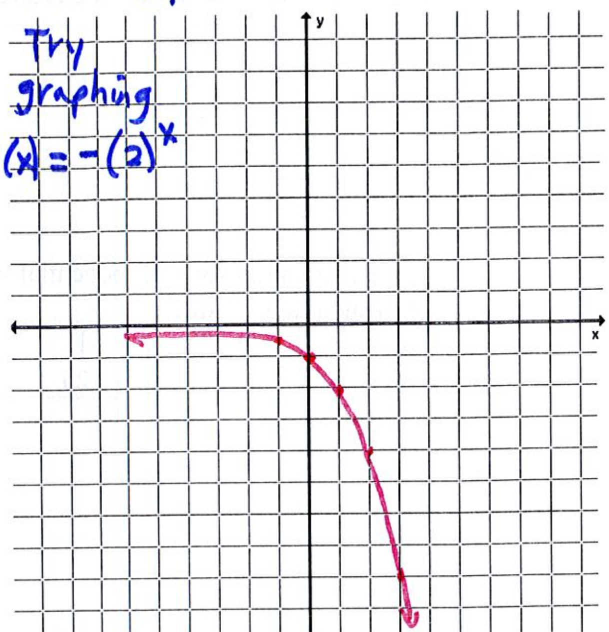
A. II. $a>0$ $0<b<1$

Try graphing $f(x)=3\left(\frac{1}{3}\right)^x$



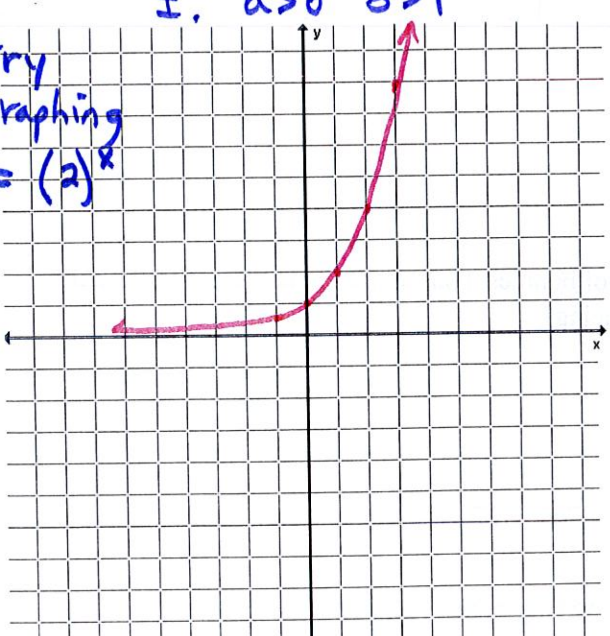
B. II. $a<0$ $b>1$

Try graphing $f(x)=-(2)^x$



B. I. $a>0$ $b>1$

Try graphing $f(x)=(2)^x$



D. IV $a<0$ $0<b<1$

Try graphing $f(x)=-\left(\frac{1}{4}\right)^x$